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(54) Method, mechanism and apparatus for momentary compression of filter material

Verfahren, Vorrichtung und Vorrichtung zur momentanen Komprimierung von Filtermaterial

Procédé, mécanisme et appareil de compression momentanée de matériau de filtre

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Description

[0001] The object of the invention is a method and an apparatus for a momentary compression of a filter material used to manufacture tobacco industry products.

[0002] In the tobacco industry, cigarettes provided with filters are manufactured, whereas the filters can be made of one kind of material or can be composed of multiple materials having different physical and filtering characteristics. The filter material in a continuous form, for example acetate, is cut into rods and applied to the cigarettes. In addition, filters manufactured of several concentrically arranged filter material layers are known. Filters having several segments of different materials are more and more frequently used in the cigarettes manufactured in present times. Machines for manufacturing multi-segment filter rods of continuous multi-segment filter rods are known in the prior art. Such machines combine the segments delivered from multiple feeding devices, whereas the segments are formed by cutting filter rods transferred for example on a drum conveyor using a cutting head provided with rotary knives. Individual segments are combined, depending on the apparatus, next to one another on a drum conveyor or one after another on a linear conveyor in order to finally form a linearly moving continuous multi-segment rod being cut into individual multi-segment rods. At the further stages of the cigarette manufacturing process the multi-segment rods are cut into individual multi-segment filters applied to individual cigarettes.

[0003] A very significant aspect of the production of filter rods of different known kinds is the quality of segment wrapping with a wrapper. The quality is determined by both the deformation of the wrapper in the region of an adhesive seam and the filling of the wrapper with the filter material.

[0004] Members for compression in the form of immovable pressing bars which heat up during the operation and lead to material damage are known in the prior art. The US patent 3,716,443 disclosed an apparatus for manufacturing filter rods of a continuous filter material wherein a member for forming an endless filter rod was used, whereas such member is cooled by means of compressed air. Due to the use of compressed air a thin layer reducing the friction between the filter material and the guiding members is formed.

[0005] The problem to be solved by present invention is to develop an improved apparatus and a method for compression of the filter material.

[0006] The gist of the invention is a method according to Claim 1.

[0007] A method according to the invention is characterised in that the filter material is gradually compressed by means of a set of multiple rotary compressing members acting on the material being compressed with a different force.

[0008] A method according to the invention characterised in that the force exerted by successive rotary compressing members on the filter material is increasing.

[0009] A method according to the invention characterised in that the force exerted on the filter material is directed in a vertical direction.

[0010] A method according to the invention characterised in that the force exerted on the filter material is directed at an angle to the vertical direction.

[0011] The gist of the invention is also an apparatus according to Claim 6.

[0012] Furthermore, an apparatus according to the invention is characterised in that it comprises two rotary compressing members.

[0013] An apparatus according to the invention is characterised in that it comprises three rotary compressing members.

[0014] An apparatus according to the invention is characterised in that the last rotary compressing member, counting in the direction of movement of the filter material, has a smaller working width than the preceding compressing members.

[0015] An apparatus according to the invention is characterised in that it is adapted to the adjustment of position of the rotary compressing members in at least one axis, preferably in all axes.

[0016] An apparatus according to the invention is characterised in that it is adapted to the adjustment of the angle between an axis of the linear movement of the filter material and a line of compression of the compressing mechanism, in particular the line determined by the centres of rotation of the rotary compressing members.

[0017] An apparatus according to the invention is characterised in that the rotary compressing member is a compressing roller with a cylindrical working surface.

[0018] An apparatus according to the invention is characterised in that the rotary compressing member is a compressing roller with a conical working surface.

[0019] An apparatus according to the invention is characterised in that the rotary compressing member is a compressing roller with an oval working surface.

[0020] An advantage of the method and the apparatus according to the invention is an effective operation with a low-cost and simple embodiment of the solution according to the invention. The solution according to the invention is, in addition, free of drawbacks of solutions known in the prior art, i.e. it does not heat up during the operation, and it does not cause material damage either. The compressing members roll on the surface of the filter material differently from the solutions known in the prior art where the effect of sliding of the pressing bars on the filter material occurred.

[0021] The object of the inventions was shown in detail in a preferred embodiment in a drawing in which:

Fig. 1 diagrammatically shows a fragment of a machine for manufacturing multi-segment rods,

Fig. 2 shows a compressing mechanism in a front view,

Fig. 3 shows a compressing mechanism in a top view,

Fig. 4 shows an embodiment of a rotary compressing member,

Fig. 5 shows another embodiment of a rotary compressing member,

Fig. 6 shows another embodiment of a rotary compressing member,

Fig. 7 shows a section of a continuous filter rod during material decompression,

Fig. 8 shows a section of a continuous filter rod after material decompression,

Fig. 9 shows an alternative embodiment of the compressing mechanism,

[0022] Fig. 1 diagrammatically shows a fragment of a machine for manufacturing multi-segment rods. A delivery unit 101 delivers filter segments S prepared in a known way onto a conveyor 102, whereas onto its surface a wrapper 103 is placed. During the transfer of segments on the conveyor 102 the wrapper 103 is wrapped in a known way around the segments and glued, whereas the adhesive is delivered from an adhesive applying apparatus 104 and an adhesive seam is heated up by a heater 105. A multi-segment continuous rod CR formed in such a way is transferred further and is cut into filter rods FR by means of a known cutting head 106 provided with knives 107. Typical members supporting and guiding the endless rod CR and the filter rods FR were omitted in the drawing.

[0023] An apparatus for a momentary compression of the filter material constitutes a part of a machine for manufacturing rods of the filter material. It comprises members for guiding the wrapper and the filter material, and a compressing mechanism 11 a fragment of which was shown in Fig. 2. The compressing mechanism 11 is situated above the moving filter material, for example in the form of segments S, whereas the wrapper into which the segments are wrapped was not shown. An example mechanism comprises three rotary compressing members 10 situated one after another, whereas in the embodiment shown the centres of the compressing members 10 lying on the axes of rotation T of the compressing members are situated on one line 12. Through the lowest positioned points, which press the material to the highest degree, a compression line 13 on the circumferential surfaces of the rotary members 10 was drawn. For the rotary members 10 with equal diameters the compression line 13 will be parallel to a line 12 going through the centres of the rotary members 10. The rotary members 10 can have different diameters, whereas the compression line defined by the lowest positioned points can be inclined relative to the axis SA of the filter material S at an angle α between 1° and 5°, preferably the inclination is between 2° and 3° depending on the filter material. An inclination of the compression line ensures that successive rotary compressing members 10 act on the filter material with an increased force. If different diameters of the rotary members 10 are used, the compression line 13 is a broken line.

[0024] Fig. 3 shows a compressing mechanism 11 for a momentary compression of the filter material in a top view. A wrapper 14 into which the segments S are wrapped can be seen here, whereas its edges were marked with the markings 15 and 16. Also an adhesive nozzle 17 of an adhesive applying apparatus, from which the adhesive is delivered onto the wrapper 14 on the edge 15, is shown in simplified representation. Three rotary compressing members 10 can be seen in the compressing mechanism 11 shown, whereas the last rotary compressing member 10A has a smaller width g2 than a width g1 of the preceding compressing members 10. The rotary compressing members 10, 10A are rotatably mounted in a body 18 by means of bearings 19. The rotary compressing members are set in rotational motion by the filter material. A torque coming from the forces of friction between the filter material and the surface of compressing members acts on each of the compressing members. However, a solution is also possible wherein they are driven by a separate drive mechanically or electronically synchronised with the drive of the conveyor 102 (Fig. 1) so that no slide between the circumferential surface of the rotary members 10 and the surface of the filter material S occurs.

[0025] The embodiments of rotary compressing members are described below. A rotary compressing member 10' rotating around the axis T shown in Fig. 4 has a circumferential surface 20 in the cylindrical form and during the operation of the mechanism exerts a force F on a continuous or segmental filter material S partly wrapped into the wrapper 14, whereas the force F is directed in a vertical direction V and causes horizontal depression of the filter material. The rotary compressing member 10" rotating around the axis T shown in Fig. 5 has a circumferential surface 21 in the conical form and during the operation exerts a force F' on the continuous or segmental filter material S partly wrapped into the wrapper 14, whereas the force F' is directed at an angle β to the vertical direction V and causes inclined depression on the surface of the filter material. Preferably the angle β is between 5° and 30°. Conducted tests showed that even more preferably the angle β amounts between 15° and 20°. A rotary compressing member 10'" rotating around the axis T shown in Fig. 6 has an oval circumferential surface 22 and during the operation exerts a force F" on a continuous or segmental filter material S partly wrapped into the wrapper 14, whereas the force F" is directed at an angle β to the vertical direction V and causes inclined concave depression of the filter material.

[0026] The position of the compressing mechanism can be selected according to the filter material and the

manufacturer's requirements. The position of the compressing mechanism can be determined in a typical way in the directions of three axes X, Y and Z (Figs. 2 and 3). In addition, the angular position of the compressing mechanism can be determined so as to select the value of the angle α of the compression line of the mechanism relative to the axis of the filter material according to the kind of the filter material.

[0027] During the manufacture of filter rods FR, before gluing the wrapper 14, the filter material S in the form of segments or in the continuous form is compressed by means of the compressing mechanism 11 in order to reduce the cross-section of the filter material. The depression and the reduction of the cross-section caused by the compression makes it possible that wrapping of the wrapper in order to obtain a cylindrical sleeve around the filter material takes place without the need of a simultaneous compression of the wrapped material. The wrapper is formed in the cylindrical shape and is glued. A decompression takes place during the wrapping and it finally ends after forming a sleeve of the wrapper. Fig. 7 shows a section of an endless filter rod during the decompression of the filter material S; a certain space P not yet filled with the filter material exists within the endless rod section, whereas the wrapper has already been formed, and the adhesive seam G has already been made. Fig. 8 shows a section of an endless filter rod after the decompression of the filter material S.

[0028] A compressing mechanism 11' according to the invention can also be embodied using an intermediate pressing member 25 (Fig. 9) between the rotary compressing members 10 and the filter material S, for example in the form of a strip or a tape. The working surface of the intermediate pressing member 25 can be shaped in any way. The use of an intermediate pressing member does not influence the effectiveness of operation of the mechanism according to the invention.

[0029] An advantage of the method according to the invention is that the final decompression of the filter material takes place after forming and gluing the wrapper, which allows obtaining better filling of the wrapper.

Claims

1. A method of a momentary compression of a filter material used in the tobacco industry, wrapped into a wrapper glued with an adhesive delivered from an adhesive applying apparatus on a machine for manufacturing filter rods, **characterised in that**
before wrapping the filter material (S) with the wrapper (14), the filter material is compressed to reduce its cross-section by exerting a force (F) on the filter material (S) by means of at least one rotary compressing member (10), the rotary compressing member rotating about an axis (T), such that a decompression of the filter material takes place in the wrapper, formed in a cylindrical shape and glued.

2. A method as in claim 1 **characterised in that** the filter material (S) is gradually compressed by means of a set of multiple rotary compressing members (10) acting on the compressed material (S) with a different force.

3. A method as in claim 2 **characterised in that** the force (F) exerted by successive rotary compressing members (10) on the filter material (S) increases.

4. A method as in any of the claims 1 to 3 **characterised in that** the force (F) exerted on the filter material (S) is directed in a vertical direction.

5. A method as in any of the claims 1 to 3 **characterised in that** the force (F', F") exerted on the filter material (S) is directed at an angle (β) to the vertical direction.

6. An apparatus for manufacturing filter rods of the filter material used in the tobacco industry comprising at least one mechanism for a momentary compression of the filter material, wrapped into a wrapper glued with an adhesive delivered from an adhesive applying apparatus, placed before the adhesive applying apparatus,
characterised in that
it comprises at least one rotary compressing member (10), the rotary compressing member arranged to rotate about an axis (T), for pressing the filter material (S) linearly moving underneath it to reduce its cross-section such that a decompression of the filter material takes place in the wrapper, formed in a cylindrical shape and glued.

7. An apparatus as in claim 6 **characterised in that** it comprises two rotary compressing members (10).

8. An apparatus as in claim 6 **characterised in that** it comprises three rotary compressing members (10).

9. An apparatus as in claim 7 or 8 **characterised in that** the last rotary compressing member (10A), considering the direction of movement of the filter material (S), has a smaller working width than the preceding compressing members (10) .

10. An apparatus as in any of the claims 6 to 9 **characterised in that** it is adapted to the adjustment of position of the rotary compressing members (10) in at least one axis, preferably in all axes.

11. An apparatus as in any of the claims 6 to 9 **characterised in that** it is adapted to the adjustment of an angle (α) between an axis (SA) of the linear movement of the filter material (S) and a line of compression (13) of the compressing mechanism, in particular a line (12) determined by the centres of rotation of the rotary compressing members (10) .

12. An apparatus as in any of the claims 6 to 11 **characterised in that** the rotary compressing member (10) is a compressing roller with a cylindrical working surface (20).

13. An apparatus as in any of the claims 6 to 11 **characterised in that** the rotary compressing member (10) is a compressing roller with a conical working surface (21).

14. An apparatus as in any of the claims 6 to 11 **characterised in that** the rotary compressing member (10) is a compressing roller with an oval working surface (22).

Patentansprüche

1. Verfahren zur momentanen Komprimierung von einem in der Tabakindustrie verwendetem Filtermaterial, das in eine Umhüllung eingehüllt wird, die mit einem Klebstoff geklebt wird, der von einer Klebstoffauftragsvorrichtung an einer Maschine zur Herstellung von Filtersträngen zugeführt wird,
dadurch gekennzeichnet, dass
vor einer Einhüllung des Filtermaterials (S) mit der Umhüllung (14) das Filtermaterial durch Ausüben einer Kraft (F) auf das Filtermaterial (S) mit Hilfe von zumindest einem Drehkomprimierteil (10) zum Verringern dessen Querschnitts komprimiert wird, wobei das Drehkomprimierteil um eine Achse (T) rotiert, so dass eine Dekomprimierung des Filtermaterials in der Einhüllung erfolgt, die in eine zylindrische Form gebracht und verklebt wird.

2. Verfahren wie in Anspruch 1, **dadurch gekennzeichnet, dass** das Filtermaterial (S) stufenweise mit Hilfe von einem Set von mehreren Drehkomprimierteilen (10) komprimiert wird, die auf das komprimierte Material (S) mit einer unterschiedlichen Kraft einwirken.

3. Verfahren wie in Anspruch 2, **dadurch gekennzeichnet, dass** sich die Kraft (F) erhöht, die durch aufeinanderfolgende Drehkomprimierteile (10) auf das Filtermaterial (S) ausgeübt wird.

4. Verfahren wie in einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Kraft (F), die auf das Filtermaterial (S) ausgeübt wird, in einer vertikalen Richtung ausgerichtet ist.

5. Verfahren wie in einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Kraft (F', F"), die auf das Filtermaterial (S) ausgeübt wird, in einem Winkel (β) zu der vertikalen Richtung ausgerichtet ist.

6. Vorrichtung zur Herstellung von Filtersträngen aus einem in der Tabakindustrie verwendetem Filtermaterial, umfassend mindestens einen Mechanismus zur momentanen Komprimierung von dem Filtermaterial, das in eine Umhüllung eingehüllt wird, die mit einem Klebstoff geklebt wird, der von einer Klebstoffauftragsvorrichtung zugeführt wird, wobei die Vorrichtung vor der Klebstoffauftragsvorrichtung platziert ist,
dadurch gekennzeichnet, dass
sie zumindest ein Drehkomprimierteil (10) aufweist, wobei das Drehkomprimierteil so angeordnet ist, dass es um eine Achse (T) rotiert, um das Filtermaterial (S) linear bewegend unter sich zur Verringerung dessen Querschnitts zu drücken, so dass eine Dekomprimierung des Filtermaterials in der Einhüllung erfolgt, die in eine zylindrische Form gebracht und verklebt wird.

7. Vorrichtung wie in Anspruch 6, **dadurch gekennzeichnet, dass** sie zwei Drehkomprimierteile (10) aufweist.

8. Vorrichtung wie in Anspruch 6, **dadurch gekennzeichnet, dass** sie drei Drehkomprimierteile (10) aufweist.

9. Vorrichtung wie in Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** das letzte Drehkomprimierteil (10A) entsprechend der Bewegungsrichtung von dem Filtermaterial (S) eine kleinere Arbeitsbreite als das vorangegangene Drehkomprimierteil (10) hat.

10. Vorrichtung wie in einem der Ansprüche 6 bis 9, **dadurch gekennzeichnet, dass** sie für die Einstellung der Position von den Drehkomprimierteilen (10) in zumindest einer Achse, vorzugsweise in allen Achsen, angepasst ist.

11. Vorrichtung wie in einem der Anspruche 6 bis 9, **dadurch gekennzeichnet, dass** sie für die Einstellung des Winkels (α) zwischen einer Achse (SA) von der linearen Bewegung von dem Filtermaterial (S) und einer Komprimierungslinie (13) von dem Komprimiermechanismus, insbesondere einer Linie (12) bestimmt durch die Drehzentren von den Drehkomprimierteilen (10), angepasst ist.

12. Vorrichtung wie in einem der Anspruche 6 bis 11, **dadurch gekennzeichnet, dass** das Drehkomprimierteil (10) eine Komprimierwalze mit einer zylindrischen Arbeitsoberfläche (20) ist.

13. Vorrichtung wie in einem der Anspruche 6 bis 11, **dadurch gekennzeichnet, dass** das Drehkomprimierteil (10) eine Komprimierwalze mit einer kegelförmigen Arbeitsoberfläche (21) ist.

14. Vorrichtung wie in einem der Anspruche 6 bis 11, **dadurch gekennzeichnet, dass** das Drehkomprimierteil (10) eine Komprimierwalze mit einer ovalen Arbeitsoberfläche (22) ist.

Revendications

1. Un procédé de compression momentanée d'un matériau filtrant utilisé dans l'industrie du tabac, enveloppé dans une enveloppe collée avec un adhésif délivré par un dispositif d'application d'adhésif sur une machine pour fabriquer des tiges de filtre,
caractérisé en ce qu'
avant d'envelopper le matériau filtrant (S) avec l'enveloppe (14), le matériau filtrant est comprimé pour réduire sa section transversale en exerçant une force (F) sur le matériau filtrant (S) au moyen d'au moins un élément de compression rotatif (10), l'élément de compression rotatif tournant autour d'un axe (T), de sorte qu'une compression du matériau filtrant a lieu dans l'enveloppe, constituée d'une forme cylindrique et collée.

2. Un procédé selon la revendication 1, **caractérisé en ce que** le matériau filtrant (S) est comprimé progressivement au moyen d'un ensemble d'éléments de compression rotatifs multiple (10) agissant sur le matériau comprimé (S) avec une force différente.

3. Un procédé selon la revendication 2, **caractérisé en ce que** la force (F) exercée par des éléments de compression rotatifs successifs (10) sur le matériau filtrant (S) augmente.

4. Un procédé comme dans l'une quelconque des revendications 1 à 3, **caractérisé en ce que** la force (F) exercée sur le matériau filtrant (S) est dirigée dans une direction verticale.

5. Un procédé comme dans l'une quelconque des revendications 1 à 3, **caractérisé en ce que** la force (F', F") exercée sur le matériau filtrant (S) est dirigée selon un angle (β) par rapport à la direction verticale.

6. Un appareil pour fabriquer des tiges de filtre en matériau filtrant utilisé dans l'industrie du tabac comprenant au moins un mécanisme de compression momentanée du matériau filtrant, enveloppé dans une enveloppe collée avec un adhésif délivré par un appareil d'application d'adhésif, placé avant l'appareil d'application d'adhésif,
caractérisé en ce qu'
il comprend au moins un élément de compression rotatif (10), l'élément de compression rotatif étant agencé pour tourner autour d'un axe (T), pour presser le matériau filtrant (S) se déplaçant linéairement sous lui afin de réduire sa section transversale de telle sorte qu'une décompression du matériau filtrant ait lieu dans l'enveloppe, constitué d'une forme cylindrique et collée.

7. Un appareil selon la revendication 6, **caractérisé en ce qu'**il comprend deux éléments de compression rotatifs (10).

8. Un appareil selon la revendication 6, **caractérisé en ce qu'**il comprend trois éléments de compression rotatifs (10).

9. Un appareil selon la revendication 7 ou 8, **caractérisé en ce que** le dernier élément de compression rotatif (10A), compte tenu du sens de déplacement du matériau filtrant (S), a une largeur de travail plus petite que les éléments de compression précédents (10).

10. Un appareil comme dans l'une quelconque des revendications 6 à 9, **caractérisé en ce qu'**il est adapté au réglage de la position des éléments de compression rotatifs (10) pour au moins un axe et de préférence pour tous les axes.

11. Un appareil selon l'une quelconque des revendications 6 à 9 **caractérisé en ce qu'**il est adapté au réglage de l'angle (α) entre un axe (SA) du mouvement linéaire du matériau filtrant (S) et une ligne de compression (13) du mécanisme de compression, en particulier une ligne (12) déterminée par les centres de rotation des éléments rotatifs (10).

12. Un appareil comme dans l'une quelconque des revendications 6 à 11, **caractérisé en ce que** l'élément de compression rotatif (10) est un rouleau de compression avec une surface de travail cylindrique (20).

13. Un appareil comme dans l'une quelconque des revendications 6 à 11, **caractérisé en ce que** l'élément de compression rotatif (10) est un rouleau de compression avec une surface de travail conique (21).

14. Un appareil comme dans l'une quelconque des revendications 6 à 11, **caractérisé en ce que** l'élément de compression rotatif (10) est un rouleau de compression avec une surface de travail ovale (22).

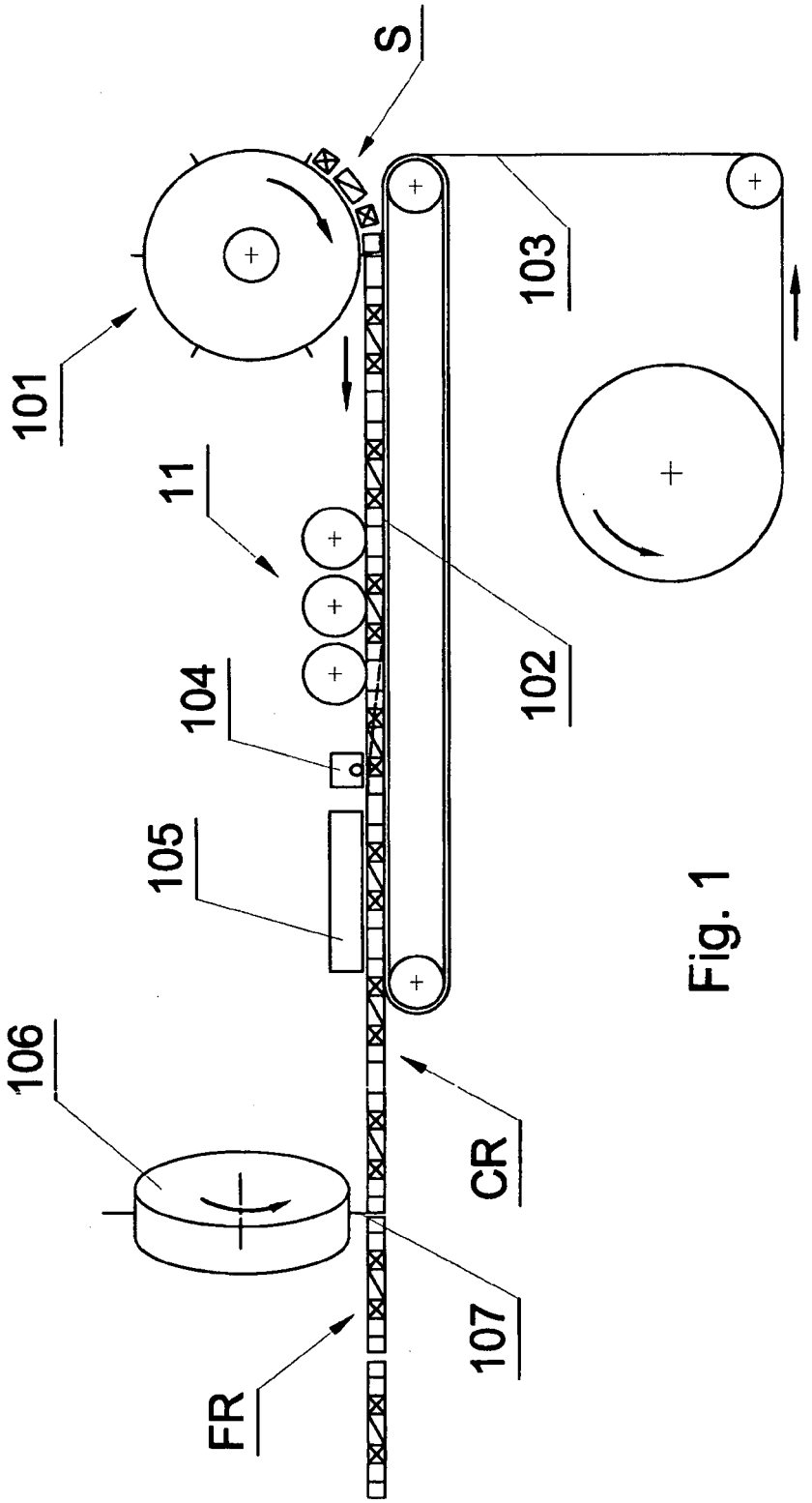

Fig. 1

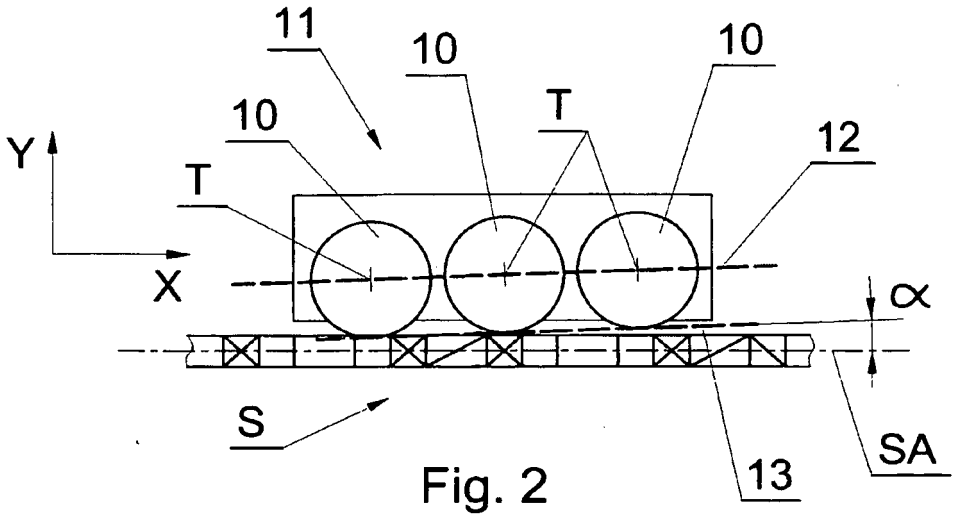

Fig. 2

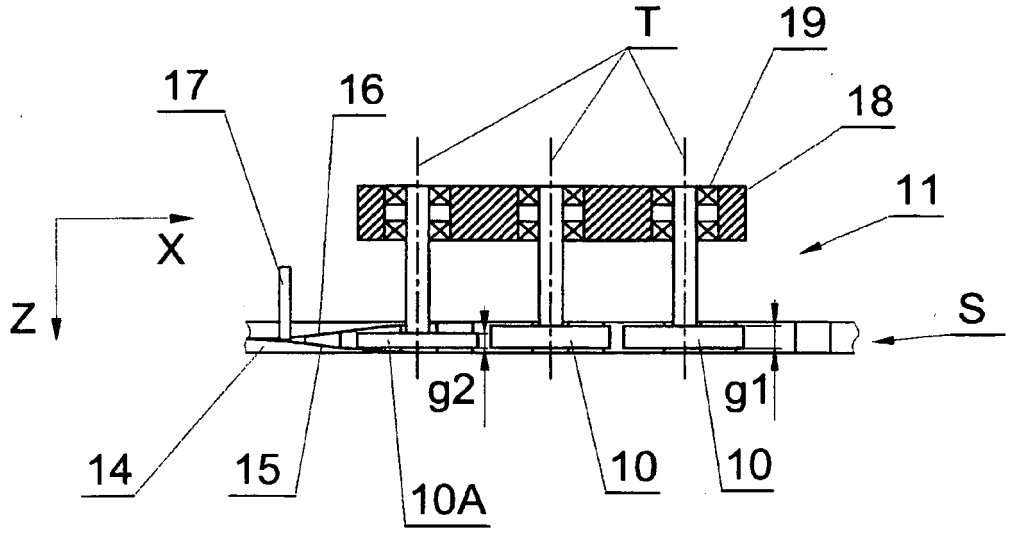

Fig. 3

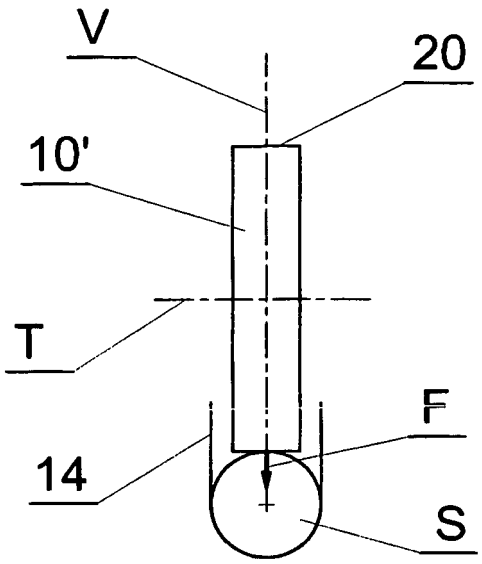

Fig. 4

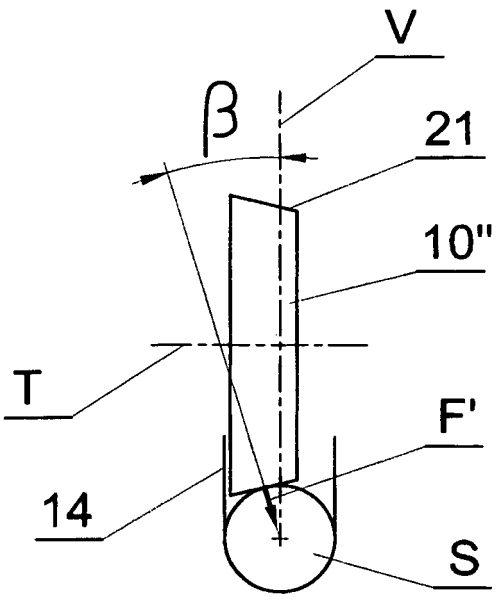

Fig. 5

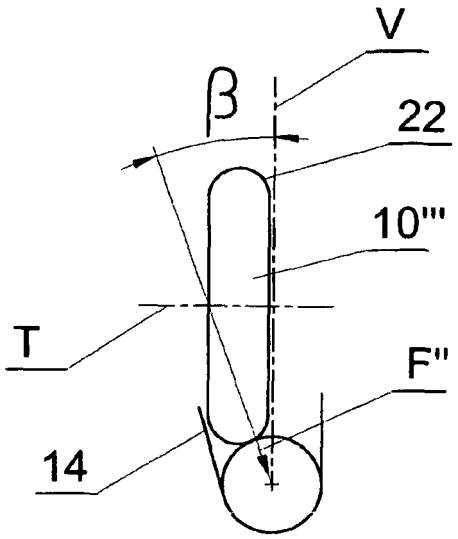

Fig. 6

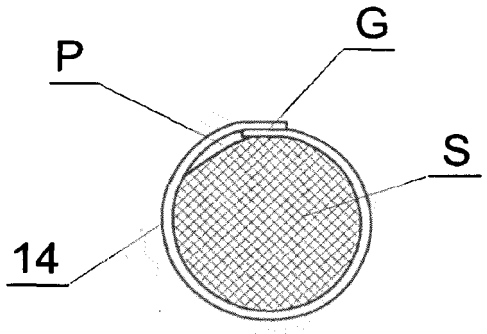

Fig. 7

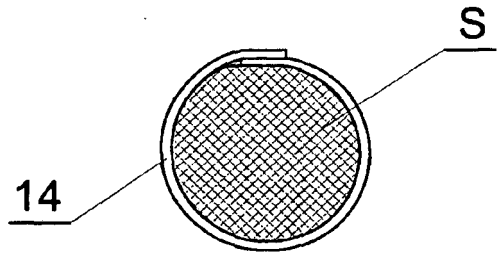

Fig. 8

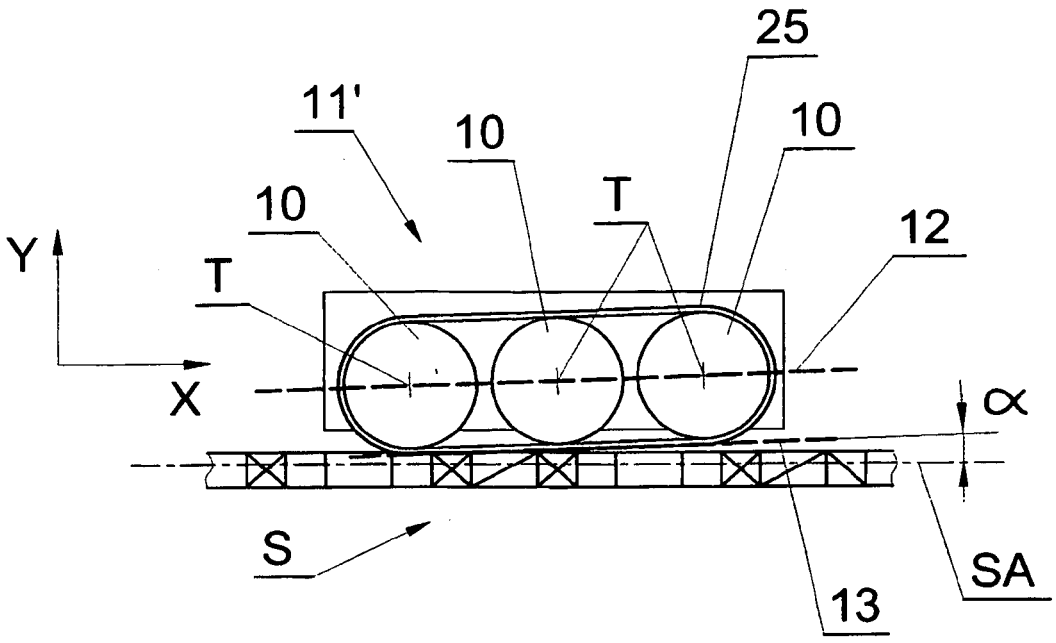

Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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